

State of Maryland
Board of Natural Resources

Maryland's Commercial Fishing Gears
I. THE FIN-FISH GEARS

COIT M. COKER



February, 1949
Educational Series, No. 18

Department of Research and Education
SOLOMONS ISLAND, MARYLAND

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MARYLAND'S COMMERCIAL FISHING GEARS

I. THE FIN-FISH GEARS

COIT M. COKER

INTRODUCTION

This report is a part of the Educational Series of the Department of Research and Education. It presents brief descriptions of the five major types of gears used to catch fish commercially in Maryland*. It indicates how each gear is fished and what it catches. The five types in use are called pound net, gill net, fyke net (including eel pot), haul seine and otter trawl. A sixth type, purse seine, is mentioned, although it is now barred in Maryland. Each type illustrates a different principle of capture, involving impoundment, entanglement, entrapment (with or without bait), encirclement and scooping. Thirteen to twenty million pounds of fish are caught in them with a monetary value of about \$1,500,000 annually. They help to harvest from Maryland waters a naturally produced crop (fig. 1) which otherwise might largely go to waste from the standpoint of human consumption. How large this harvested crop is and what proportions are taken by each type of gear is revealed in Tables 1 and 2 which show the total commercial catch in pounds for the three typical years 1944, 1945 and 1946. Bay and Ocean catches are considered separately.

Nets basically similar to those described here have been in use for a long time. Developments and improvements have come with increasing knowledge of the habits and movements of the various species of fish. Most nets are designed to take advantage of known behavior of fish in response to barriers, food, current, spawning impulses and so on. Fishermen manage to keep two or three jumps ahead of the fish, figuratively speaking, so much so that if there were no restrictions at all on construction and use of capturing devices, it is likely that stocks of certain species, some more vulnerable than others because of their habits, could be removed from the waters, at least to the point where the law of diminishing returns would cause a cessation of fishing or reduce the fishing effort and resulting catch to negligible proportions. This would be particularly true of an area such as Chesapeake Bay, the relatively small size and shallow depths of which compared with

* The accompanying diagrams illustrate the general scheme of each gear and are not intended to be accurate in detail.

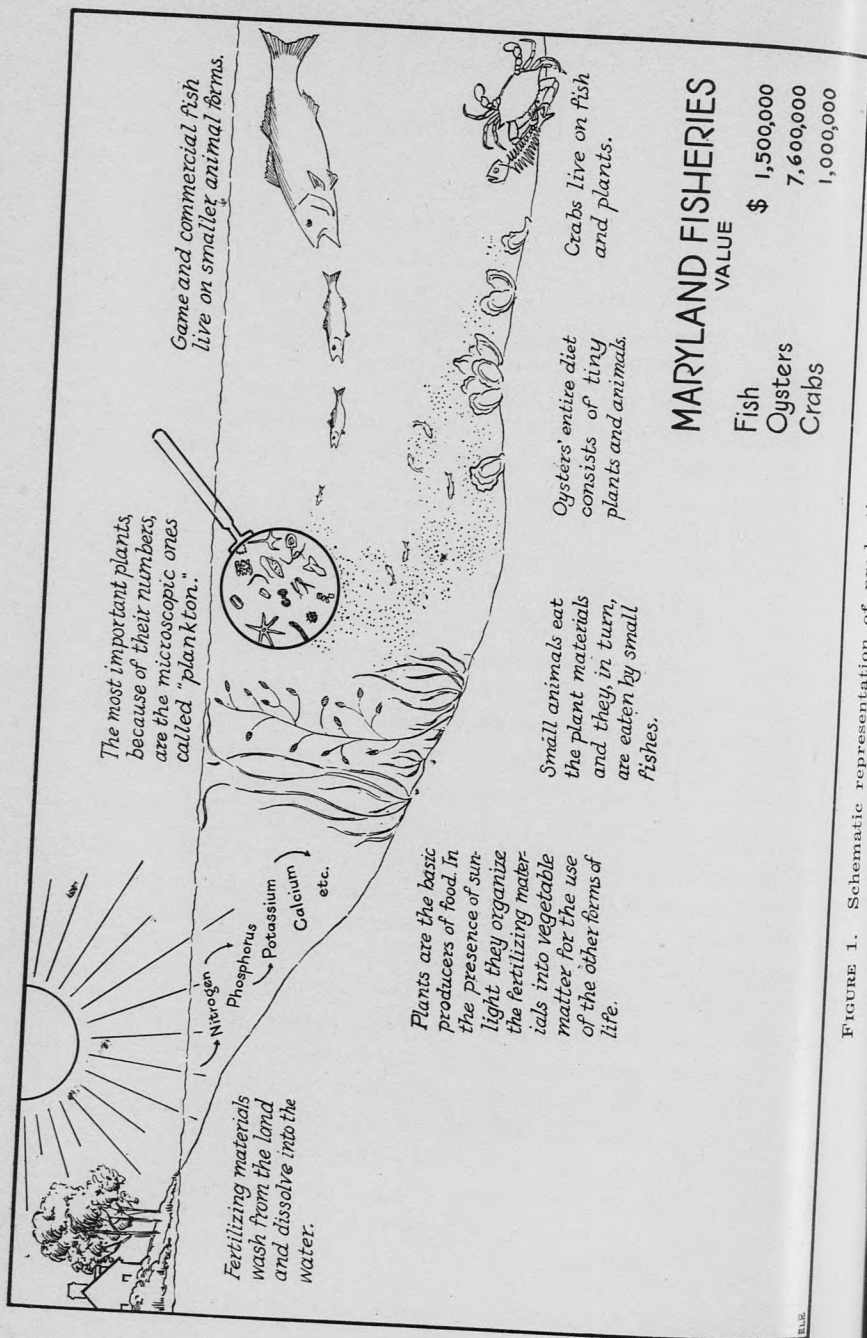


FIGURE 1. Schematic representation of production in water.

the ocean, would make it easy to fish it completely, were no limitations placed on the amount and type and use of gears.

Many of those whose livelihood depends upon their fishing efforts realize that some means of control are necessary to prevent depletion of the stocks by overfishing. They know that an adequate broodstock of adult fish must be left in the water to provide future supplies of fish and that the young fish produced each year need some protection until they reach a given size.

States that have a commercial fishery of importance have made various regulations aimed at preventing undesirable netting practices to the end of maintaining the fishery at high levels of production. Such regulations include some or all of these principles:

- (1) Closed seasons
- (2) Closed areas
- (3) Limitation of types of gear
- (4) Limitation of size of gear and size of mesh
- (5) Limitation of amount of gear
- (6) Limitation of total catch or of catch per unit of gear
- (7) Limitation of method of operating the gear
- (8) Limitation of size of fish that may be caught or retained after catching.

Fishery control legislation in Maryland includes elements of all of the above principles except for the placing of limitations (No. 6) of total catch or of catch per unit of gear. The basic part of the state's conservation program, as applied to the Bay fishery, is known as the "Maryland Management Plan". This plan, introduced legislatively and supported by the fishermen, themselves, a few years ago, limits the total amount of commercial gear that may be fished in Maryland but, at the same time does not hamstring the individual fisherman in the use of his gear. Briefly stated, the Maryland Management Plan limits the number of fishing licenses to a level which is felt to be consistent with the supply of fish. Fishermen now operate their licensed gear with a minimum of restriction, but additional men or units of gear may not enter the industry until the catch trend of the fishery is upward. Such controlled fishing effort as is aimed at by the plan should, under proper administration, assure that sufficient broodstock is left to repopulate the waters, other things being equal.

Each licensed fisherman is also required by law to send in periodic statements of the amount of fish that he has caught. These records, coded and treated on a strictly confidential basis, enable the State to

TABLE I

TOTAL ANNUAL CHESAPEAKE BAY FISH CATCH
BY MARYLAND GEARS IN 1944, 1945 AND 1946

GEAR	1944		1945		1946	
	POUNDS	%	POUNDS	%	POUNDS	%
Pound Nets	7,077,657	51.0	5,664,082	57.9	6,522,764	56.7
Haul Seines	4,258,498	30.7	2,438,539	24.9	3,245,129	28.2
Gill Nets	2,011,938	14.5	1,373,250	14.0	1,388,679	12.1
Fyke Nets	501,429	3.6	262,986	2.7	334,949	2.9
Other Gear	23,495	0.2	38,705	0.5	15,400	0.1
Total	13,873,017	100.0	9,777,562	100.0	11,506,921	100.0

determine how many fish are being withdrawn from the waters each year by any and all of the gears. So well is the statistical program operating, with full cooperation of the fishermen, that information is readily available on the catch by gear, by area, by species and by season. Such an inventory is essential, of course, to enlightened fishery management. Readers who wish to know more about the plan and its practical results can find more complete discussion in other pamphlets of the Educational Series (see reference list at the end of this pamphlet).

In years gone by, nets were made laboriously by hand. Nowadays, the major portion of netting is made by machinery. Handwork still goes into the hanging, or rigging, of the machine-made netting with lines, weights, corks, etc., to form the finished net. Fishermen can order a net completely rigged or, as very often is the case, they order

TABLE II

TOTAL ANNUAL OCEAN FISH CATCH BY MARYLAND GEARS
IN 1944, 1945, AND 1946. LANDINGS AT OCEAN CITY

	1944		1945		1946	
	POUNDS	%	POUNDS	%	POUNDS	%
Pound Nets	1,847,683	64.3	1,114,090	29.8	1,098,217	17.3
Otter Trawls	1,025,921	35.7	2,626,129	70.2	5,245,458	82.7
Total	2,873,604	100.0	3,740,219	100.0	6,343,675	100.0

netting of desired length and depth and size of mesh and rig it themselves. Most of this work, and of later mending jobs, is done with the aid of two simple little tools, a net-mending needle (fig. 2) and a jack-knife. A good job of hanging, however, requires knowledge and skill born of long experience.

The fish catch of Maryland watermen is handled variously. The great volume landed at Ocean City is bought from the fishermen by fish companies located there and boxed, iced and shipped by the

latter to city markets. The Bay catches are landed daily at numerous points along the Western Shore and bayside Eastern Shore. Where there are no packing houses, processors, or filleting plants established nearby, the individual catches are trucked or sent by rail to wholesalers. Large quantities of fish reach the ultimate consumer "in the round"; i.e., as whole fish. Lesser quantities are processed by canneries and filleting plants. Due to the close proximity of fishing grounds to landing points, Bay fishermen do not find it necessary to ice their catches or to clean the fish prior to landing. Most of the handling procedure done by them is confined to sorting the fish. A recent survey by members of the Department (Miller, 1947) indicated that there is much room for improvement in the handling of the catches after reaching shore, so as to present a better product to the consumer

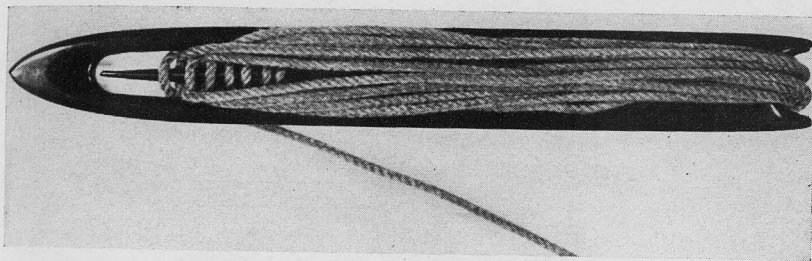


FIGURE 2. A net mending needle.

and to properly utilize valuable waste material potentials for the manufacture of by-products.

A number of terms used in the text may be unfamiliar to the reader. They have been kept, however, because they are in common use by fishermen. A glossary of definitions is provided at the end of the report.

POUND NETS

A pound net is a large stationary fishing device constructed of poles and netting arranged so as to form a trap. Setting one out or taking it up requires a lot of time and effort and can not, under practical conditions, be done in a day. Therefore, once a pound net is in place, it is left in position for an extended period. Essential parts are the leader, heart and pound. These are illustrated in fig. 3. The leader extends from the pound toward the shore. Migrating fish and those that move up or down the shore line approach the barrier provided by the

POUND NET

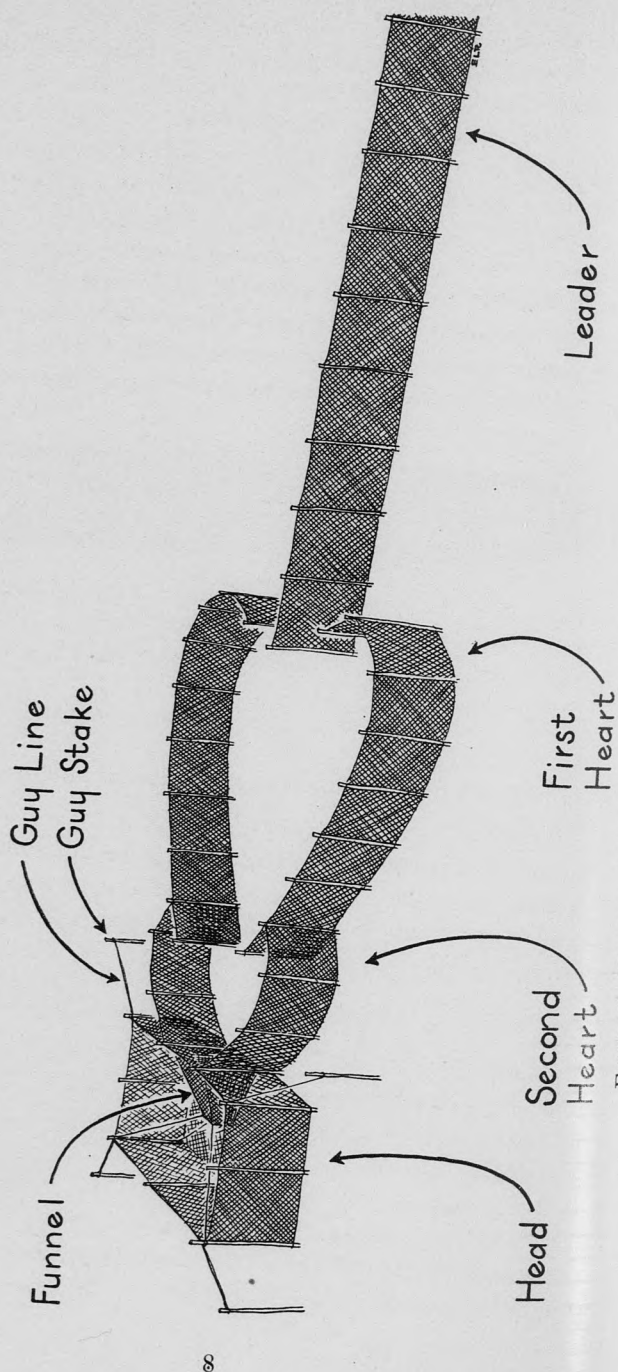


FIGURE 3. Diagram of pound net. Most of this gear, when set, is under water.

netting of the leader, turn away from the shore toward deeper water in order to get around this barrier, and thus are directed toward the pound head. Near the head, they are guided into the heart by its backward projecting wings and then, attempting to escape from the heart, pass into the pound head, sometimes termed "pot" or "pocket" or "crib", by means of the funnel, in some instances called "throat" or "tunnel". Some pounds are provided with an additional, shallower, pocket off to one side of the first head and reached from the latter by means of another funnel. Once inside of a head, the mass of the fish tend to remain there, although a few may find the way of escape; however, the design of the heart is such that if a fish does come back out of the head into the heart, the netting guides him again toward the head. The main fishing seasons for this gear are spring and fall.

Maryland's pounds are small, generally speaking; however, they are the largest single units operated to catch fish within the State. They are expensive to install and maintain. Some idea of the expenses may be obtained by considering these requirements: several hundred yards of strong netting, rigging lines, more than one hundred telephone-pole-size stakes, labor to fit out the net and maintain it, equipment to sink the stakes into the bottom and to remove them at the end of the season, boats and miscellaneous equipment to handle the catch, pay for crew members, etc.

The Catch: The make-up of a given catch depends largely upon whether the net is located in a river, in a bay or in the ocean. The ten leading species caught by Maryland pound nets in 1945 were, in order: river herring, gray trout, rock, croaker, shad, white perch, sea herring, catfish (and bullheads), spot and butterfish.

The productivity of a single pound net depends upon a number of factors including the favorableness of the location, skill of the operators in setting the net, size of the net, abundance of fish, vagaries of fish movement and the weather. A location that is favorable one year may not be profitable for the operator the following year, even though fish are being taken in the general region of his set. Similarly, the catch on a given day may be a few pounds of trash fish or it may be several thousand pounds of commercial varieties. The large capital outlay involved and the expense of upkeep make it necessary to realize a good seasonal return in order to make continued operation profitable. Fairly reliable figures indicate that the average gross return from a pound net per annum amounts to about \$1,400.

How Fished: More than one man is needed to operate and fish the gear. In some cases, a group of fishermen pool their resources and set up a cooperative in which they share expenses, work and profits. In other cases, the gear and equipment are owned by one man who takes on crew members at a regular pay plus some share in the profits. A crew varies in number from four to ten individuals, and may fish several pound nets.

The net is fished in the morning at or near slack tide because at this time weather and water conditions are usually calmest. The remainder of the day can be devoted to sorting, weighing, shipping and selling the catch. Crew members go out in a power boat, behind which is towed one or more non-powered boats. They tie up the funnel, then the lines holding the head are slacked off on one side so that part of the netting of the head can be drawn up to the boat in such a way that the impounded fish are schooled into a smaller space to be removed by means of a wide-ring dip-net. When the pound net has been fished "dry", lines are tightened up again, the funnel is re-opened, and the men return to shore with their catch.

Care of Gear: Storms may destroy the whole gear or parts of it. Sharks or other large fish may tear holes through the netting. Logs and other objects sometimes float into and through the netting. Netting rots, becomes encrusted with barnacles and the like, or chafes against the sharp edges of encrusted fouling organisms on the poles. Poles rot, are weakened by boring worms, may be broken off in storms or pushed over by boats off their courses. Properly treated netting, given good quality material to start with and reasonable care and mending during service, should last two or three years, barring catastrophic conditions. Poles are rarely used for more than two seasons and generally serve for a single year.

Poles used by Maryland pound net fishermen at this time are given no special treatment to make them impervious to rot or resistant to the action of boring and fouling organisms. When a pole, sometimes termed "stake", goes bad it is replaced with a new one. The law requires that stakes must be taken up and removed from the waterway within one month of the cessation of fishing and since pound nets are not fished the year around, an opportunity is thus provided annually for a complete inspection of all stakes. Fouling organisms present on or in the stakes are killed by drying during the three or four months' period that the stakes are on shore.

Netting is an expensive item to replace, besides being fragile and susceptible to decay. Hence, it receives frequent treatment to the end of preserving it. As received from the manufacturer, it is generally plain cotton cord netting. After being rigged in with the necessary lines, it is run through a tank of molten tar at a temperature of about 200°F. or else is steeped in some other treating bath such as copper oleate solution. This treatment may be given again after a certain amount of usage, and, typically, should be applied at the end of the season. Every time the head is fished, it is inspected for holes and, if such are found, it is mended on the spot with treated twine. The leader and heart are inspected occasionally for possible tears in them. The net may be changed every two or three weeks when peak rotting conditions obtain in the water. When the net is taken up, it is passed over a rack on shore for detailed inspection and complete overhauling, rotten spots being cut out and mended, weakened lines replaced and the fouling removed. Another preservative bath treatment is given before the gear is reset or stored until the following season.

Modifications: Pound net gears in Maryland are modified chiefly in overall size. River and bay pounds run from 100 to 1,500 feet in length and from a few feet to twenty feet in depth. Ocean pounds may have 90' poles and netting 50' deep. Some gears have more than one heart; some have an additional head extending from the first head and connected to it by a funnel; occasionally, fishing crews will install a netting cover over the head especially during the summer, its purpose to prevent depredations to the catch by cormorants, eagles, ospreys and gulls,

GILL NETS

Gill nets capture fish by entanglement. They are very long nets that range from 100 to 3,000 yards and are constructed of extremely fine linen or cotton twine. When in operation, they are suspended in the water somewhat like a fence (fig. 4). Weights, consisting of metal rings, are attached to the bottom, and floats are placed along the top line to hold them in an upright position. A fish swimming by fails to notice the netting until his head has passed through the mesh opening and the fine twine has caught behind the gill covers. If his body is too large to pass on through the mesh, he can now go neither backwards nor forwards very far and is entangled (fig. 5). Size of fish captured is governed by the size of the mesh openings. It is generally

GILL NET

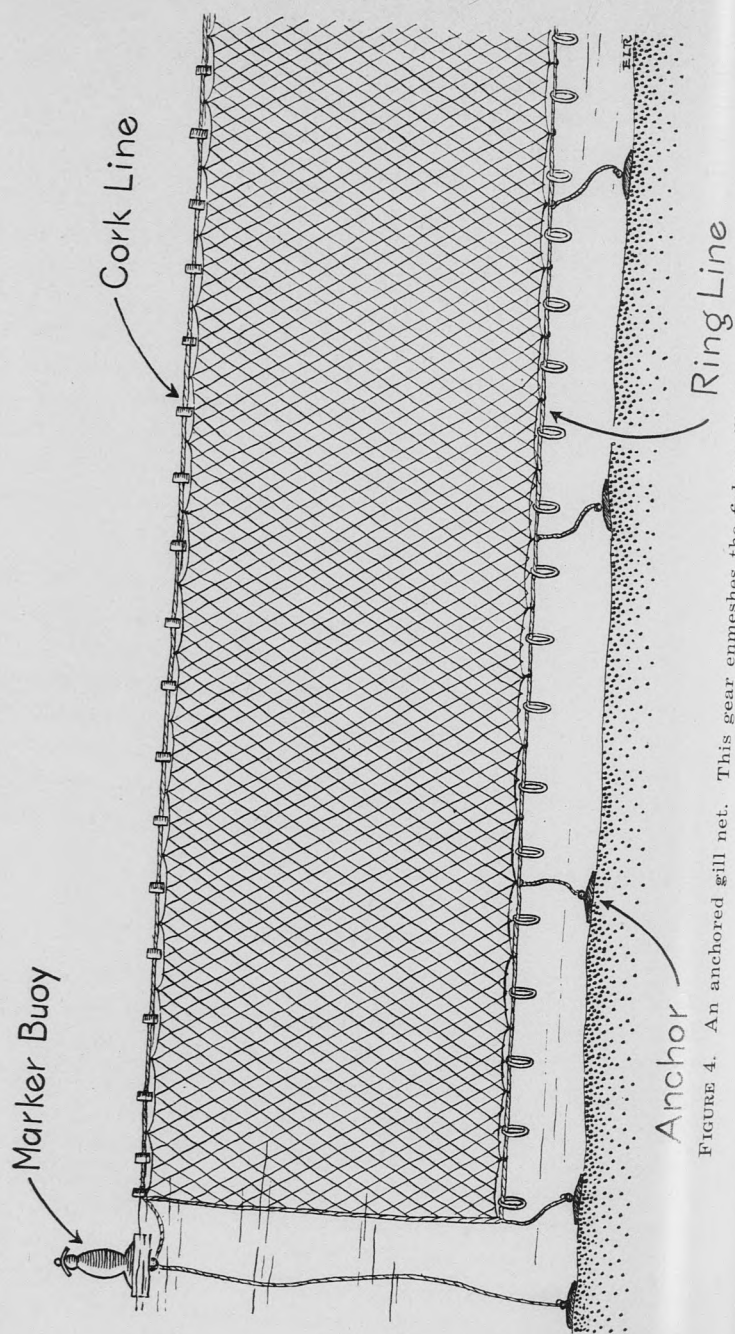


FIGURE 4. An anchored gill net. This gear enmeshes the fish as illustrated in fig. 5.

agreed that if a fish sees or feels a net, he tends to turn away from it or try to go around it. Hence, gill nets are made of very fine natural colored twine (linen is preferred over cotton) and are fished at night unless the waters are muddy. The twine must be strong enough to withstand the struggles of the fish.

The Catch: The catch when the gill net is fished varies from no fish to as many as 1,000 depending on water conditions, the run of fish, length of net, and the skill of the operator. The average annual catch

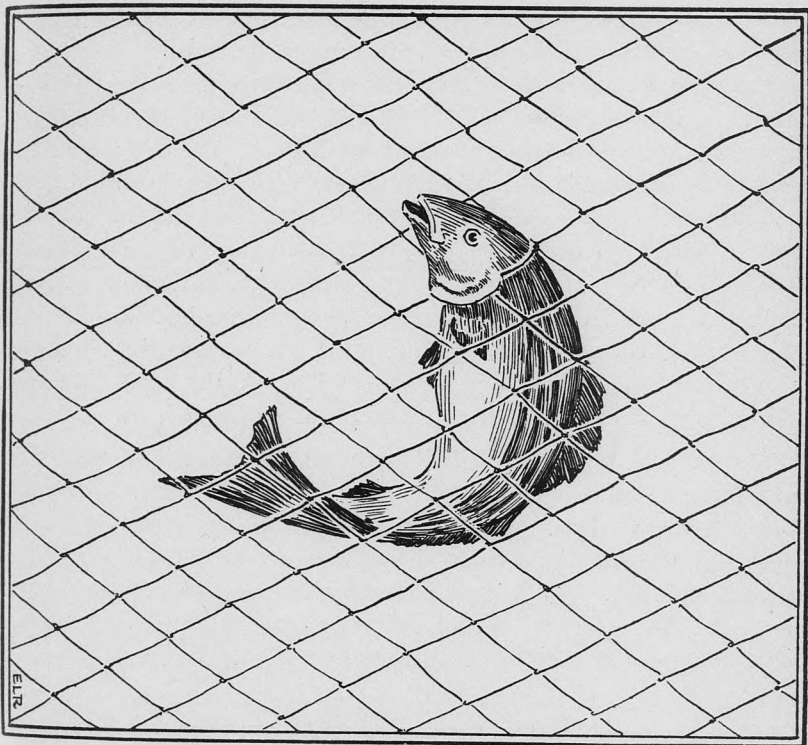


FIGURE 5. A fish caught in a gill net.

during 1945 per 1,000 yards of licensed netting was approximately 4,000 pounds valued at \$600.00.

Statistics for the year 1945 indicate that the twelve most important species taken that year by this type of gear, arranged in descending order of catch poundage, were rock, shad, white perch, herring, croaker, carp, bluefish, yellow perch, gray trout, eels, pike and spot. The first five of these made up the bulk of the catch.

How Fished: Shad fishermen in the upper Bay area handle their anchor nets in the following general manner. The net is piled up on the stern end of a large row boat, successive folds atop one another, so that when ready to be set, it will pay out over the stern easily and steadily. The boat is fitted with a long, smooth roller at the stern or else its stern has smooth contours to prevent snagging and tearing of the net as it is released. The net-carrying boat is towed out to the fishing grounds by a larger motor-powered boat which serves as living quarters for the fishermen. Shortly before slack tide, the crew get aboard the net boat and proceed to the point where one end of the net is to be anchored. From this point, one man rows while another man or two stand by the net pile to make sure that it goes over smoothly. In some cases, it is necessary to throw the cork and lead lines over continuously by hand. Anchor weights attached by lines to the net's lead line are thrown over at intervals. When the net is completely laid out, that is set, the following conditions obtain: it is marked at each end by a light in which an ordinary kerosene lantern may be attached to a wooden float; each end is anchored, and there are anchors at intervals along the length; the lead line is on or near the bottom; the cork line is at or near the surface. The net is left overboard only during the period of slack water and is taken up before the run of the next tide becomes strong enough to submerge it or carry it away.

Frequency of fishing depends largely on the individual fisherman. Some make several trips up and down the length of the net. In "pluck" fishing, as it is called, one man rows down the set repeatedly while another in the same boat keeps lifting the cork line until he feels the presence of a fish. He then pulls that part of the net in and removes the catch. In "take-up" fishing, the crew leaves the net out through the slack tide, but they fish it only once and that is when the net is taken up.

The water in the Susquehanna area typically is clear, resulting in good visibility for the fish during daylight hours; therefore, fishing takes place only at night and the greatest number of slack tides which can be fished in twenty-four hours is two, sometimes only one. In the Potomac River, where a drift net fishery is carried on, not far below Washington, the water is less clear due to the volume of silt in it; thus all four tides can be utilized daytime as well as night. The number of men in a crew varies from one to four. The net is set out at slack water and allowed to drift along with the oncoming tide, the top of the net being about 10 feet below the water surface.

During winter, rock or striped bass retreat to the deeper holes of the Bay and are captured through the use of drift gill nets so weighted as to sink to near the bottom and drift along, upright, with the tide. Progress of the net is followed by observing the changing positions of several floats attached at the end of lines long enough to reach the surface. The lead line weights are large metal rings, 6 to 8 inches in diameter, which slide easily over the bottom. It has been found that these rings are more effective than solid weights in preventing the net from rolling up on itself as it drifts along.

Stake gill nets are most often used well upstream or close in to shore where there is little boat navigation. Anchor gill nets are set out over flats or in relatively shallow water. Drift gill nets can be set out in nearly any depth of water where there is sufficient unobstructed room for a clear sweep. The latter can be fished at any depth merely by extending lines from the net to each float.

Care of Nets: It holds true that the length of useful life of all netting depends to a great extent on the care that is taken of it by the owner or operator. Gill nets are no exception. However, they are generally fished without previous chemical treatment, for the meshes must be pliable and of a neutral color likely to be unobserved by the fish; chemical treatment such as tarring would change these desirable characteristics. Moreover, gill nets are not usually left in the water for very long periods of time, and deterioration due to immersion is minimized, thereby reducing the necessity for chemical treatment. When treatment is considered desirable, the gear can be cutched (barked), chromed or run through a special copper process.

When the boat returns to shore after a fishing trip, the fishermen spread the net out on racks, remove any entangled debris, and allow the net to dry in the air before stowing it for another fishing trip or laying it away until the next season. More careful fishermen take pains to wash their nets with clean fresh water before drying them. Some give their gear a bath with lime water, followed by fresh water. Washing removes dead organisms and organic matter liable to cause rot or decay. Sometimes, the net is bedded down in dry salt until it is used again.

Linen webbing usually gives longer service than cotton. A linen net handled and cared for properly may last three to six years, while a cotton one lasts only about half that long. Deterioration comes from several causes. Bacterial action, or rot, occurs in the threads in the

water, but relatively slowly. More rapid is the bacterial action that occurs if the net is laid away damp and unclean so that fish slime, seaweed or other organic matter is left on the threads to rot. Tests by the U. S. Fish and Wildlife Service have disclosed the little known fact that direct sunlight is harmful to both wet and dry gill nets, which last longer if dried in the shade. Polluted water conditions have been blamed for rapid net deterioration in some areas.

A storm may cause loss of all or part of a gear before it can be gathered into the boat. Rents and tears can be caused by a number of factors such as seaweed clinging to strands and increasing the strain at those points; drifting heavy objects which tear the mesh; "hanging" on stationary underwater objects; large fish forcing their way through; boats which run over a surface net; snagging when the net is being paid out, taken in, or handled ashore; chewing by rodents during storage; etc.

Many fishermen find it uneconomical to attempt to repair holes unless they are very large and the net is in danger of parting. They have discovered that even large holes make very little difference in the catch of fish. Evidently the type of fish caught in gill nets, especially shad on or near their spawning grounds, are swimming around somewhat aimlessly and irregularly so that if one passes through a hole in the net, he is likely to circle back into another part of the net that will trap him.

Modifications: Gill net modifications occur chiefly in their length and depth, size of mesh (above the legal limit) and the manner of rigging—i.e., whether rigged as drift nets, anchored nets, or staked nets. The length is influenced by the extent of net the fisherman wants to fish, the extent of room he has available in which to set the net and the extent for which he is licensed. Crews that fish several water areas carry their nets in different lesser lengths which can be pieced together to make a single long one if the occasion demands. The depth of a net is tailored to conform to the depth of the water in which the fisherman intends to fish. Size of mesh depends upon the size and type of the fish to be caught, a wider mesh being required to catch the larger sizes effectively. Fishermen sometimes carry with them nets of several mesh sizes and select the appropriate one for the predominant size of fish in the area.

HAUL SEINE

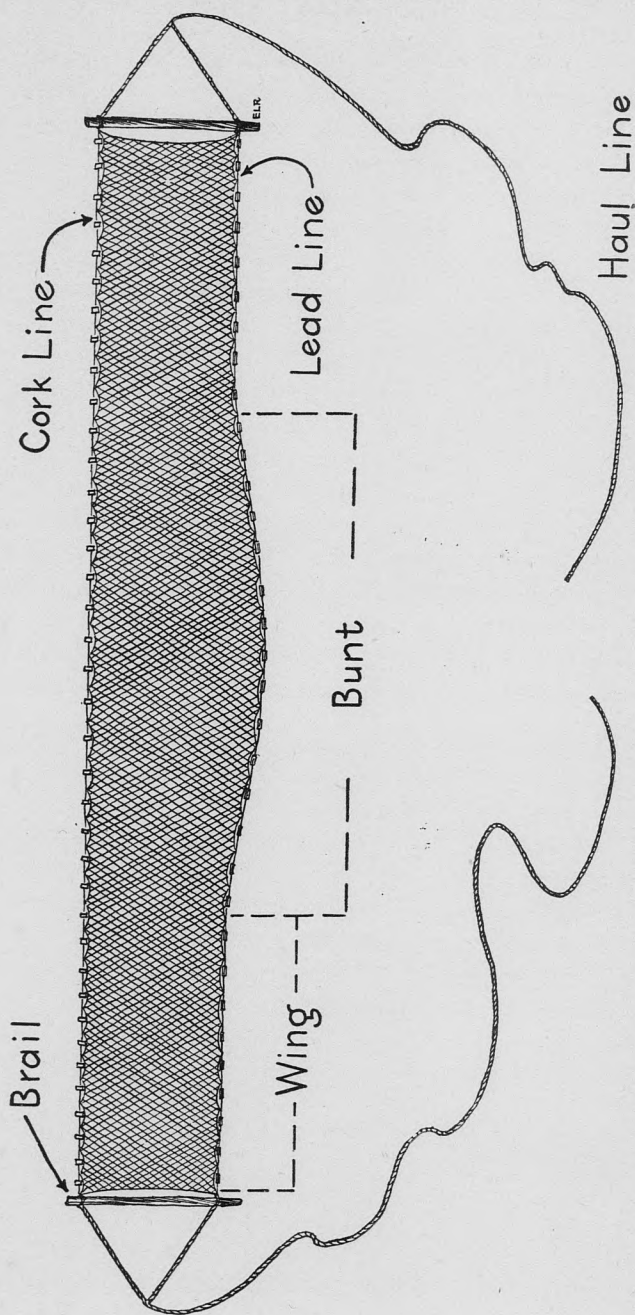


FIGURE 6. Such a seine is of fine meshing and is used to enclose fish and haul them ashore.

HAUL SEINES

Haul seines are used to surround fish, at least partially, and pull them ashore before they can get away. They are shallow nets, ranging from six to ten or more feet deep and are of variable lengths, to a legal maximum of 600 yards. They are operated principally to catch fish concentrated near shore. Corks are tied at intervals along the upper edge of the net and lead weights along the bottom edge (fig. 6). The mesh is substantially made of cotton cord strong enough to withstand considerable strain; minimum legal size of the stretched mesh is $2\frac{1}{2}$ inches. Attached upright at each end of the gear there is a strong stick, termed the "brail", which serves the purpose of keeping the net spread at the ends. There are four main lines: (1) the cork line, lashed in along the top of the net; (2) the lead line, lashed in along the bottom; (3) and (4) the two long haul lines, one attached to the brail at each end of the net so that the seine may be pulled. Cork and lead lines may be of manila; however, the haul lines, though strong, are usually of a softer, more pliant material, such as cotton, so as to lessen wear and tear on the hands in handling. The central part of the net may be slightly wider and have a finer mesh than elsewhere; this portion is the "bunt". It may even have a definite pocket shape. The portions of the net on either side of the bunt are known as the "wings".

The Catch: Nearly all species of commercial fish of the Bay are represented in haul seine catches. The principal fishery, however, is for croaker and rock, although white perch, carp, catfish, alewives, spot and trout are caught in appreciable quantities. Biggest catches are made at times when the fish are assembled in large schools in suitable areas, especially in the spring migrations and at spawning times. On rare occasions, exceptionally large catches are made, running into many tons. As a general rule, the catches are small and when the total fishery picture of the State is considered, it is seen that these occasional large catches by haul seines account for a relatively minor amount of the total fish catch by all gears.

How Fished: An ideal fishing location is a stretch of beach along which fish congregate and where there are no underwater obstacles to entangle the net. The free end of one of the haul lines is tied to some firm object on shore. The net and coiled haul lines are placed in the stern of a boat so that they will pay out easily without fouling. The boat is rowed straight out from shore until all of the haul line is out and the net starts going over the stern. Then the net is laid out,

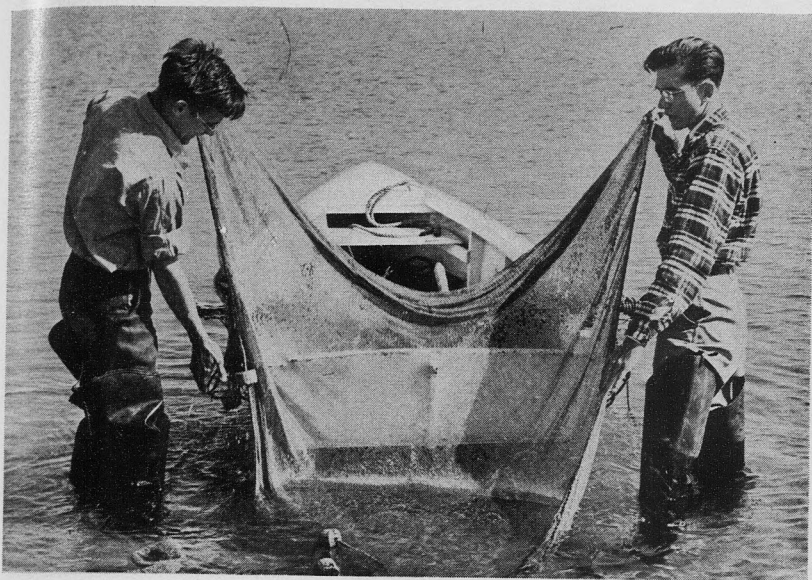


FIGURE 7. Haul seine operation, the net being boated.

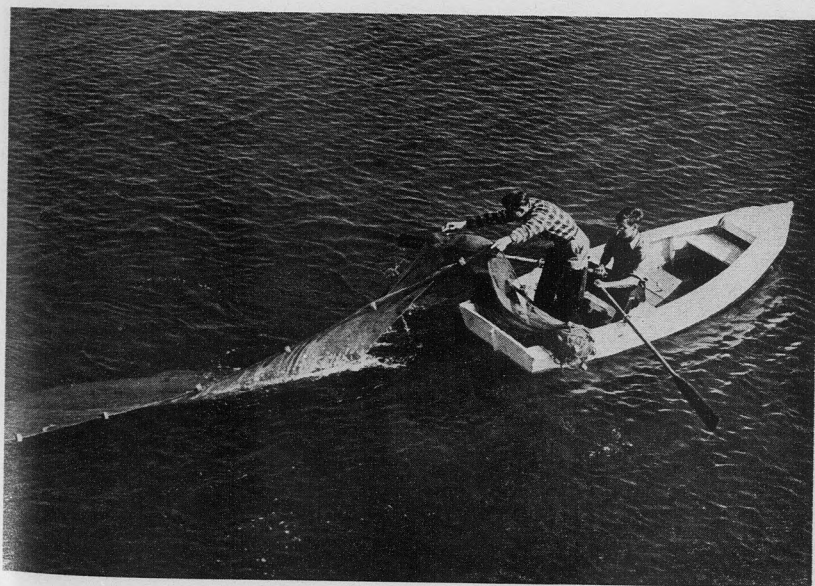


FIGURE 8. Haul seine operation, the net being payed out.

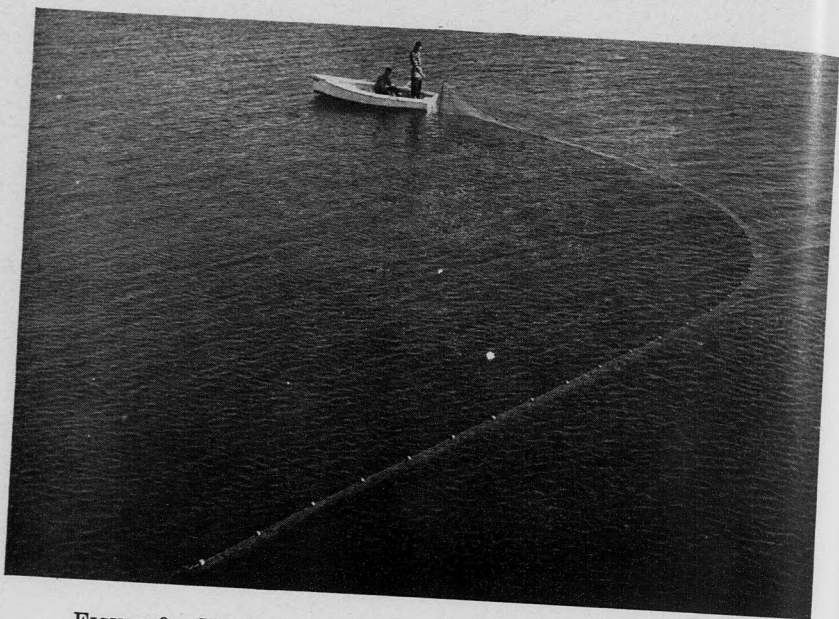


FIGURE 9. Haul seine operation, in which the net is laid out.



FIGURE 10. Haul seine operation, the net being hauled in.

quickly and smoothly, in the direction of the tide, nearly parallel to shore. Finally, the other haul line is brought to shore and the hard work of pulling the net in is commenced at both ends (figs. 7, 8, 9, 10). Caution is exercised to keep both lead and cork lines hauled in simultaneously in proper relation to each other and to keep the lead line on the bottom at all times. This normally keeps the fish from escaping; however, in spite of diligent care by the fishermen, sometimes fish jump over the top of the net and the others may decide to follow suit. Occasionally, the lead line will snag or "hang" on some underwater obstruction, at which time it is necessary for a man to go out and free that portion of the net without releasing any more fish than can be avoided. Hangs are the bane of the seine-hauler. They cause him to lose time, patience, fish and, possibly, part of the net. For these reasons, most seine-haulers are wary of fishing a new area without first exploring the bottom so that obstacles likely to foul the net may be avoided, or removed, prior to fishing. Rooted seaweed is another bane; it fouls the lead line and causes the net to twist into a tight roll which is tedious to undo. No fish are caught when this happens.

It is unlawful to empty the catch directly on the shore, for the undersized fish perish under this condition. The seine must be emptied where the water is at least 12" deep and the juvenile fish released accordingly. Not infrequently, there are no fish in the net, an undesirable situation wryly referred to as a "water haul". If there is an appreciable tide running up or down the shore, the net is laid out "with" the tide, that is, in the same direction as the current, and pulled in rapidly. No success is had in trying to buck the current, because the force of the tide against the net prevents it from being set out properly. Hauls also can be made off shore, when there is water both deep enough and shallow enough for the purpose. When hauling is done, it must be done by hand or by hand-powered winches, although the net may be laid out with a powerboat.

Two men, at least, are required to operate a haul seine, one for each end of the net. Four men make the work of hauling easier. As many as a dozen men operate a large seine. Seine haulers either roam extensively about the Bay and its tributaries making exploratory hauls here and there in search of fish, or else they use definite "stands" (fishing areas) known to be productive of fish year after year. Those who fish stands often spend considerable effort preparing the area prior to fishing. Fishermen who have not participated in locating and

preparing such a stand are not supposed to fish it, according to the unwritten code of watermen.

Care of Net: Rot and snags are the chief causes of haul seine deterioration. Snags are avoided as much as possible. Rot is fought by treating the net periodically with molten tar. A well-taken-care-of net will last for several years. Sometimes rodents attack nets in storage.

Modifications: Variations among haul seines are chiefly in length and depth of net, and in the shape of the bunt.

FYKE NETS

Fyke nets are among the most numerous gear employed in Maryland, ranking only behind gill nets in this respect. They are also the most variable in construction although certain basic features are evident in them all as shown by the simplest type which is little more than a netting bag supported by hoops, with an entrance funnel at one end, through which the fish enter into the chamber proper (fig. 11). The word fyke is derived from the Dutch word "fuik" which means a bow net. Smaller fykes are made of netting, or hardware cloth, or wooden strips, fastened around wooden or metal hoops. Larger fykes are made of strong cotton netting supported by round or oval hoops.

A second type of net consists of the basic bag and funnel arrangements with an ordinary leader, also called "hedging" or "fence". Generally, there is a bag at each end of the leader. Another type has no leader but is provided with one or two straight or curved wings extending outward from the first hoop, while still another type has a leader in addition to wings. This one resembles a typical pound net except that it is smaller and the pound is replaced by the bag.

Costs of operating this gear are relatively small. The nets are easily constructed and often are built by the fisherman, himself, or someone in the neighborhood, from purchased raw netting and locally available accessory materials such as hoops, stakes, etc. Smith ('92) describes typical examples of Maryland fykes:

With wings: "A common form, in use in Dorchester County, Maryland, and fished for terrapin, striped bass, and perch, consists of a bag 18 feet long, distended by three hoops, six feet apart; the first hoop being eight feet in diameter, the second six feet and the third four feet. Funnels proceed from the first and second hoops. The wings (locally called leaders or hedgings) are 30 to 60 feet long. A similar type, with wings 18 feet long, is known as a 'sink

FYKE NET

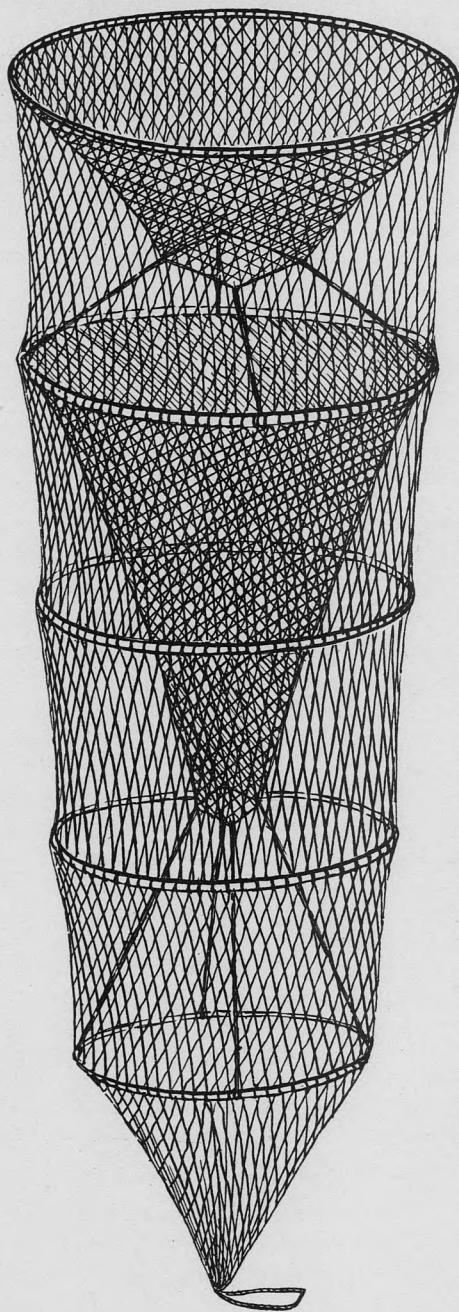


FIGURE 11. Net covered hoops of a typical Chesapeake fyke net showing two funnels.

net', on the Nanticoke River and elsewhere, and is set under the ice for striped bass and perch."

With leader and wings: "The simplest fyke of this style has an ordinary leader and two straight wings . . . It is a common net in many places and in certain parts of Chesapeake Bay is the predominant one." An example "from Queen Anne County, Maryland, may be described as follows: The length of the net proper is 12 feet. There are five hoops, with two funnels extending from the first and third hoops; the first hoop is five to eight feet in diameter. The wings are 36 feet long, and the hedging is 40 yards long . . . Similar nets in the same region are 14 to 18 feet long, with leader from 40 to 100 yards in length. Rarely, the hedging is constructed of laths nailed on cross-pieces supported by uprights. These nets are adapted to the capture of striped bass, yellow perch, catfish, alewives, pike . . . A fyke net with curved wings like those of a pound is used in Queen Anne and other counties on the Eastern Shore . . . A net thus constructed is often considerably larger than the kind with straight wings used in the same region. The hoops, four or five in number, have two funnels. The bag or pocket is 15 to 20 feet long. The hedging is from 40 to 100 yards in length. The 'forebays' are from five to thirty yards long . . . In some localities, as for instance, the Chester River, nearly all the fykes employed are of this class."

Double fykes: "The double nets . . . consist of two simple fykes placed opposite each other, with a common leader, with or without wings, and connected on one side by a short piece of netting. The fykes are, in most types, set at right angles to the leader, but in some cases they diverge, forming an obtuse angle with the leader.

"An example of a simple form of double net . . . is used in the Nanticoke River and elsewhere in Chesapeake Bay, and is there usually called a set of fykes. It consists of two bags set facing each other, connected on one side by a curved piece of netting; from the other side, a leader extends from the shore to a point opposite the entrances of the nets. The bags are 18 feet long and are separated from each other by a distance of 10 to 12 feet. There are five or six hoops and two or three funnels. The first hoop is five or five-and-a-half feet in diameter, and each succeeding hoop is smaller by about three inches. The leader, or hedging, is 75 to 120 feet long, and consists of netting with a three-and-a-half inch mesh. The improvements made in this style of fyke consist in the addition of wings of various shapes and sizes."

The Catch: Fyke nets characteristically are located in rivers and creeks. The species caught by this gear are those that enter or are resident in such streams. In 1945, for example, the following were the main species taken by this gear, listed in order of importance (pound-age): catfish and bullheads, white perch, yellow perch, pike or pickerel,

eels, river herring, carp, croaker, rock, black bass*, sunfish and shad.

How Fished: Two men can easily handle the ordinary fyke net. In fishing, the bag is lifted up to the boat and the fish removed by releasing a drawstring at the back part of the rear chamber. Then, the net is placed back overboard, anchored in position or secured to stakes. The season runs all the year round, although not much fishing is carried on during the hot summer months when higher water temperatures are conducive to rapid rot. Fykes are largely confined to the small streams and bodies of water tributary to the Bay, in areas where pound nets would be impracticable. Often one man will have as many as a half dozen or more nets which he fishes himself or on shares with a helper. Ordinarily, fishing takes place daily, in the morning. Otherwise, it takes place whenever the fisherman can find time from his other activities. Baits are unnecessary.

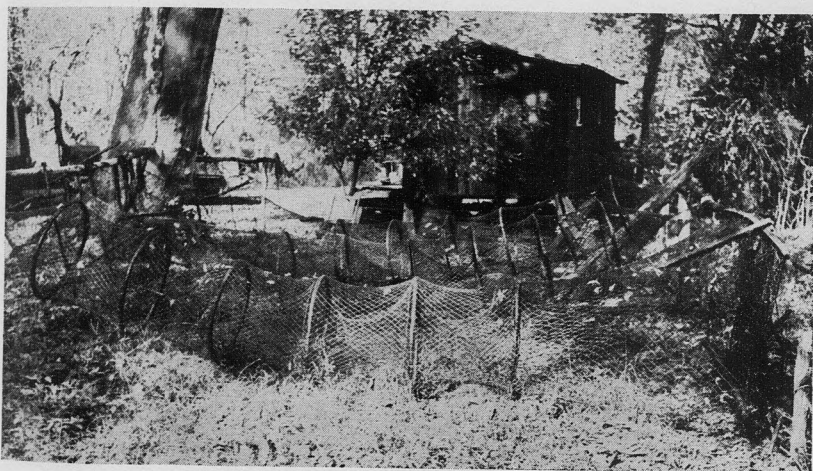


FIGURE 12. FYKE NETS. These nets (near North East, Md.) are being dried after treatment with tar prior to the fishing season. Note that these examples have rectangular mouths, six wooden hoops, and three funnels.

Care of Net: Fyke nets are less subject to the hazards of weather, current, and shipping, for they are employed normally in more or less protected waters. Wear and tear, rot and fouling organisms are main causes of deterioration. Preservative treatment consists of periodic dipping of the entire gear, exclusive of stakes, in hot tar which gives

* Black bass are not allowed to be caught commercially at the present time.

a protective coating to the netting and hoops (fig. 12). When not in use, the net is cleaned, dried, folded to more compact form, and stored under cover in a dry place. The normal length of life is about three years.

Modifications: Indications have already been given of the tremendous variation in shape, size and general features of fyke net construction. Factors which determine this variation are the local custom, inventive genius of the individual fisherman, physical characteristics of the local waterways, material available, and habits of the principal species of fish to be caught. The one binding feature which make all of the variants recognizable as fyke nets is the bag with its system of funnels and hoops.

The very smallest of nets on the fyke principal, the "eel pot" as it is universally known, deserves especial consideration due to its widespread use in the Bay area as well as elsewhere. It is rarely more than three feet long by six to twelve inches in diameter. One type is made of white oak splints woven around a mold. Eels enter at one end

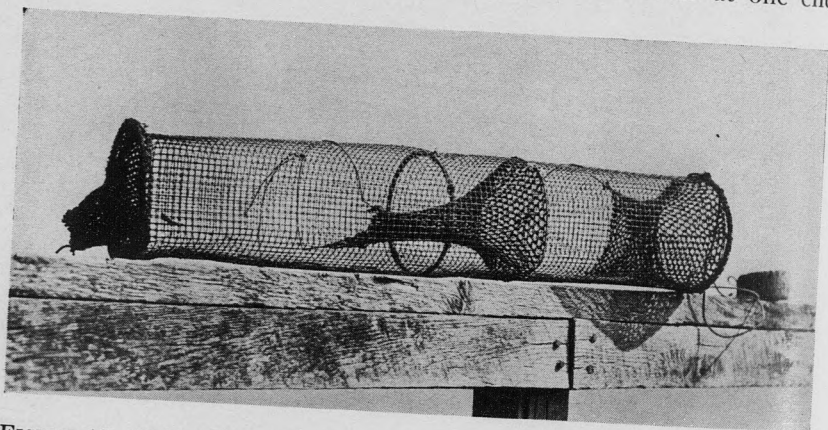


FIGURE 13. EEL POT. This type is constructed of $\frac{1}{4}$ " mesh galvanized hardware cloth over steel rings. Funnels, and the sleeve at the rear, are made of cotton netting. Diameter 8".

through a funnel; at the other end is a circular wooden plug which is removable when emptying the trap of eels. Another type is constructed of hardware cloth and has one or two funnels made of hardware cloth or netting (fig. 13). A netting sleeve at the hinder end can be unpursued by a drawstring for the removal of the catch. Eel pots are baited. The most commonly used baits are pieces of alewives, menhaden and crushed hard crabs. Each pot is weighted so as to rest on

the bottom. In some cases, each pot is marked with a buoy, while in others many pots are tied at intervals along a long line each end of which may be marked with a buoy.

OCEAN FISHING GEARS

Two of the most effective gears developed for the capture of fish are the otter trawl and the purse seine, both of which are operated from sea-going vessels. Neither of these types is allowed to be operated in the Maryland portion of Chesapeake Bay because of conservation reasons. The trawl is used extensively, however, in off shore waters of the Atlantic and a sizeable annual catch is landed at the rapidly growing fishery port of Ocean City, Maryland. In 1933, a storm opened up an inlet there, which made it possible for small ocean fishing vessels that operate nearby to enter a protected harbor. Many small trawlers that operate in the middle Atlantic section have taken advantage of this harbor to bring in and land their catches rather than proceed to points further north or south. Some of these are resident trawlers, that is, have Ocean City as a home port.

OTTER TRAWL

An otter trawl is a large bag-like net which is towed through the water, either at the bottom to catch groundfish such as fluke, or near the bottom for schooling fish. Essentially, it is a scoop. See figs. 14 and 15. Spread out, viewed from above, it has a triangular shape, tapering to the rear. The posterior part is the "cod end" which is double meshed for extra strength; there is a drawstring at the very end. The open anterior end is the "mouth"; its upper lip is provided with floats strung along the "head rope" to keep it buoyant. The lower lip, extending back somewhat further than the upper lip, is heavily weighted with a chain or wire, known as the "foot rope", and may have rollers attached to it so that it will move freely along the bottom. Each side of the mouth is extended as a short wing which is attached by bridle lines to a rectangular "otter board" or "door", constructed of wood braced with metal. The function of the doors is, by a planing or kiting action, to keep the mouth spread open as the net moves through the water. From each door, a wire bridled towing cable runs to the trawling vessel. The underside of the cod end of bottom trawls is covered by some replaceable material known as "chafing gear". This may be a sheet of tough cowhide, or it may consist of numerous eight to twelve

OTTER TRAWL

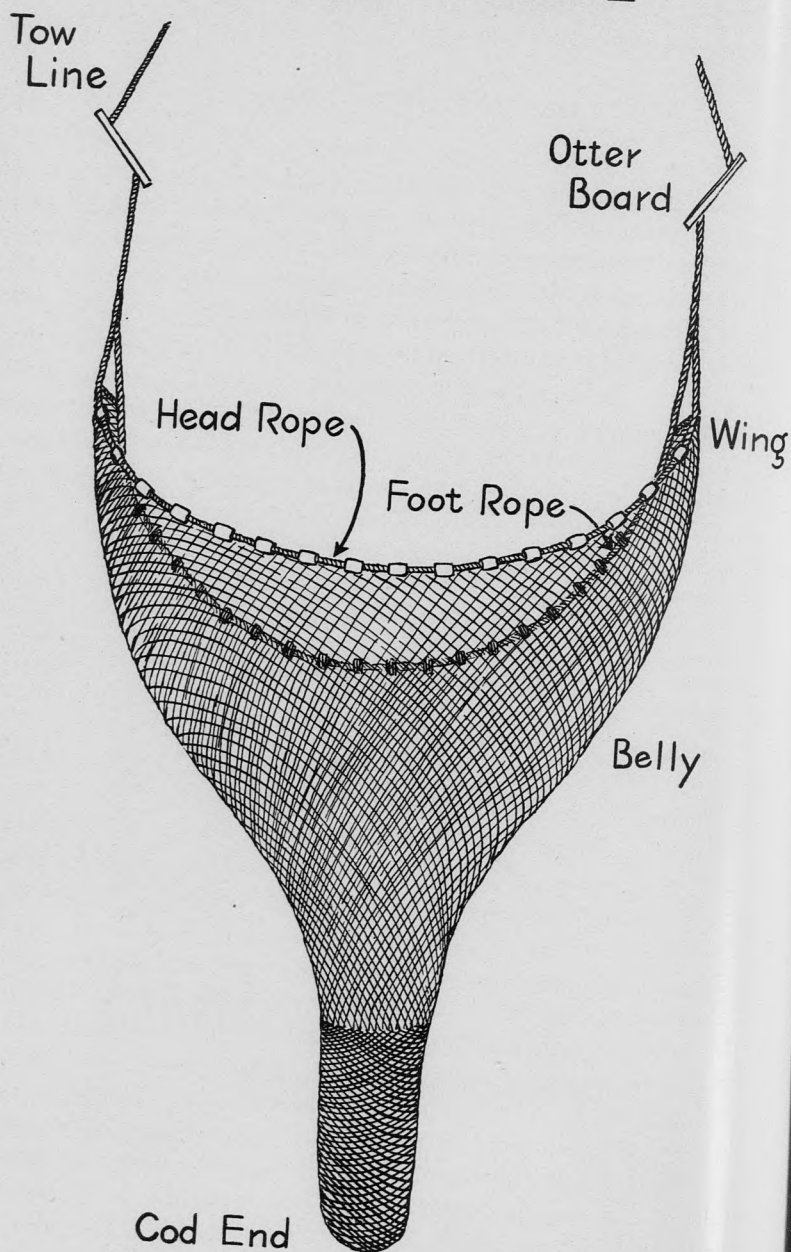


FIGURE 14. Rough diagram of otter trawl.

inch long manila fibers tied in such a manner as to form a thick mat. The replaceable chafing gear protects the cod end as it slides along the bottom. The cowhide chafing gear is termed "bullskin".

Trawls are operated from sea-going vessels which can go out and fish day and night in nearly any kind of weather. Large vessels, some of them more than 100 feet long, measure 151 or more gross tons, medium vessels 51 to 150 gross tons, and small vessels five to fifty gross tons. Those that operate out of Ocean City fall in the smaller categories known as "draggers".

The Catch: Leading species caught by this gear in 1945 were porgies, croaker, fluke, gray trout, whiting and cod. Appreciable quantities were also taken of seabass, rock, bluefish, butterfish, sea herring, flounder, conch*, king whiting, spot, and squid*. Other species caught in lesser amounts were squirrel hake, bonito, swellfish, sturgeon, sand perch, horse mackerel, tuna, eels, sea mullet, mackerel, shad and tautog.

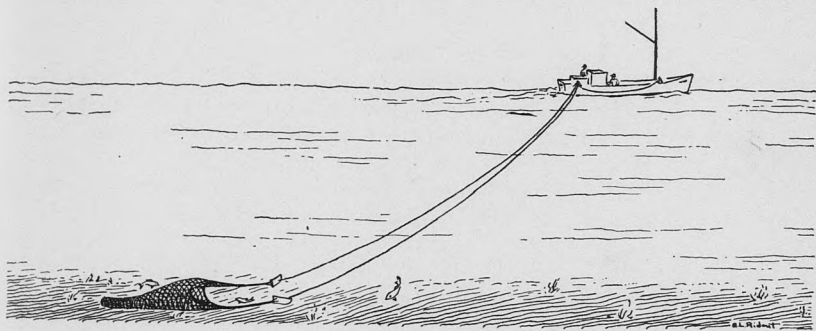


FIGURE 15. Diagrammatic sketch of otter trawl in operation.

Trawlers usually go to an area in the ocean where they expect to find a certain species of fish and operate there for that species. Sometimes a lot of searching takes place before profitable concentrations of fish are found. Other marketable species that happen to be caught in the net are "gratefully received" but are not the prime object of the hunt, unless there develops indication that large quantities of such are available.

How Fished: Actual setting, fishing and hauling in of the net has been described (Pearson, '32) as follows:

"In setting the trawl, the wire cables are run through fair-leads to and through the gallow sheaves, one forward and one aft on

* Conch and squid are mollusks, not finfish.

the side from which it is proposed to set. The cables are then shackled to the chain bridles of the trawl boards, which, in turn, are secured to either wing of the trawl. The vessel is then brought beam to the wind, the net being on the windward side. The cod end is then tied up and put overboard, the balance of the net being paid out as the vessel drifts to leeward away from it. A float (usually a ballon-shaped canvas bladder) is secured to the center of the top of the bag. The net is now all gone into the water, with the exception of the ends of the wings, which are attached to the otter boards hanging at the gallows.

"Both towing cables are now slowly paid out for a short distance, and the vessel moves slowly ahead, turning toward the side from which the net is being set. This is continued until the otter boards have spread the net properly, and the whole apparatus has assumed the position for fishing. The cables are then paid out until the net has reached the bottom, when they are stopped and shackled together near the stern of the vessel.

"The trawl is now towed slowly along the bottom at a rate of from two to three miles per hour, usually from thirty minutes to one hour. Then the cables are released from the shackle at the stern, the winches are started, and as the net comes up the vessel is again brought broadside to the wind, with the net to the windward, and stopped. The otter boards are brought right up to the gallows blocks, and the net is further brought in by quarter lines run to the gypsy heads of the trawling winches, the crew taking in the slack of the net by hand. When the ends of the quarter lines are in, the footrope of the net lies close alongside the vessel.

"The remainder of the net is taken in over the side by hand until the cod end, which contains the catch, is reached. The throat of the cod end is now folded over and bunched together; a sling is passed around it, to which is attached a fall on the foremast. A winch now hoists the cod end, with its contents, and swings it aboard, where it is lowered over the deck. The draw string is now released, and the catch falls out onto the deck.

"If fishing is to be continued in the same locality, the trawl is again set as before, and the crew start at once to sort and stow the marketable fish and dispose of the trash.

"Fishing continues day and night. The average number of hauls per 24 hours, under ordinary circumstances, is about 10 to 15, although this will vary according to the nature of the ground, the catch, the amount of net mending necessary and the weather. Including the passage to and from the fishing grounds, from three days to a week is usually required to get a fare of fish".

Most of the Ocean City draggers do not put out far at sea, and complete a fishing trip in 24 hours to several days.

Care of Net: Trawls receive hard usage, requiring constant repair or even replacement. Sometimes the whole gear or a major part of it is lost when a cable breaks during stormy weather or the net runs afoul of a sunken wreck. A very large fish may burst through the net. If the damage is minor, it can be repaired on board; if major, a spare net is swung into place and the other one is reconditioned on return to the landing point. Normal wear and tear supersede rot as destructive factors; however, rot is guarded against by the use of tarred twine for the netting.

Modifications: Trawls vary mostly in size of the net and its mesh, distance of the otter boards from the wings, nature of the chafing gear, if any, and particulars of rigging.

PURSE SEINE

Purse seines are not allowed to be used in Maryland waters, although they were formerly extensively employed in the menhaden fishery and still are used for this purpose by boats operating from Virginia. The principle of capture involved is somewhat similar to that of a haul seine. Differences lie in certain features of construction and operation and in the fact that purse seines are always fished in open water rather than from shore. The net is fairly large, perhaps 1,000 feet long by 60 feet deep, with one inch mesh. Lead weights placed along the bottom and corks along the top keep it floating in an upright position. There are numerous brass rings along the bottom through which passes a line by means of which the bottom of the net may be drawn together to effect an enclosure when a school of fish has been surrounded. This pursing feature gives the net its name.

When a surface school of menhaden has been sighted by lookouts on the mother vessel, two small boats, each containing one-half of the net, are put overboard and start off in opposite directions to lay the net in a circle around the fish school. When the two boats meet again the circle is complete; the bottom of the net is then pursed together, and the fish are enclosed in a "bowl" of netting. The bowl is made progressively smaller by drawing a portion of the net back into the boats. Eventually, the fish are confined in a space small enough to facilitate their being bailed out by the power-operated dipnet on the mother boat which has meanwhile come alongside. Tremendous catches up to many tons of fish are not unusual in areas where this net is employed.

GLOSSARY

- ANCHOR GILL NET**—A gill net which is held stationary in the water by anchor weights resting on the bottom and attached to the net by lines.
- BAG**—The hoop-supported bag-like trapping portion of a fyke net; or, the bag-like part of any net.
- BAR**—As applied to netting the term bar refers to the length of twine between knots and would ordinarily be one-half the length of a mesh.
- BARK**—To treat with a tanning solution made of an infusion of tanning bark.
- BRAIL**—A stick, one attached at each end of a haul seine, to keep the net spread.
- BUNT**—(1) *n.* The central part of a seine, generally somewhat bag-shaped.
(2) *v.* To gather a net into a sort of bag so that the enclosed fish may be more readily removed.
- BEAM TO THE WIND**—Said of a vessel when its broad side faces into the wind.
- CHAFING GEAR**—Replaceable material placed on the underside of an otter trawl to protect the net from wear as it slides along the bottom.
- CHAIN-BRIDLE**—As applied to an otter trawl, a chain-bridle is an arrangement of short pieces of chains fitted to an otter board somewhat like the bridle of a kite.
- CHROME**—To treat with a special chemical preservative solution (potassium dichromate).
- COD END**—The closed back part of an otter trawl which retains the captured fish until they are released on board by loosening a drawstring.
- CORK LINE**—A line strung along the top of a net, bearing corks so that the top of the net will be buoyant.
- CRIB**—See "Pound". Sometimes an additional shallower pound attached to the main pound is called the crib.
- CUTCH**—(1) *v.* To tan with a chemical solution extracted from any of several specific tropical plants (e. g., *Acacia catechu*, *Pegu catechu*).
(2) *n.* The extract from those plants.
- DOOR**—See "Otter Board."
- DRAWER**—A trawler. So-called because the otter net is dragged behind it when fishing.
- DRIFT GILL NET**—A gill net which is not held stationary in the water but is free to drift along with the water current.
- FAIR-LEAD**—A device for guiding the trawl tow line as it pays out to or from the winch.
- FALLS**—Block and tackle used for hoisting and lowering.
- FARE**—A good catch or shipload of fish.
- FENCE**—See "Leader."
- FOOT ROPE**—Rope or cable passing along the lower lip of an otter trawl.
- FOREBAY**—See "Heart."
- FOREMAST**—The mast of a ship which is nearest the bow.

- FOULING ORGANISM**—Any of a number of marine plants and animals which attach to submerged objects. Examples: barnacles, sea-squirts, algae.
- FUNNEL**—A funnel-shaped opening into a fish trap with the small end inward.
- GALLOW BLOCK**—See "Gallow-sheaves." The block contains the sheave.
- GALLOW-SHEAVES**—Grooved pulley wheels in a block supported by a gallow-like arrangement. One forward, one aft on each side of a trawler.
- GEAR**—A piece of equipment as, for example, a net-mending needle, a boat-hook, a net. A complete unit of fishing equipment.
- GYPSY HEAD**—An extra, smaller and faster winding drum attached to a winch.
- HANG**—(1) *v.* When netting is being fitted *out* with lines, corks, sinkers, etc., to make a net, the worker hangs it in such a manner that the work will be easier. Hence the operation of fitting out has come to be known as hanging.
 (2) *v.* To snare on an underwater stationary object.
 (3) *n.* An underwater stationary object which snares a net.
- HAUL LINE**—Any line used for hauling or extending a net.
- HEAD**—The foremost, or trapping portion of a pound net. See "Pound."
- HEAD ROPE**—Rope or cable passing along the upper lip of the mouth of an otter trawl.
- HEART**—The heart-shaped portion of a fish trap, designed to help guide fish into the trapping chamber. The heart is made up of two wings extended out and folded back partly.
- HEDGING**—See "Leader."
- LEADER**—A fence-like part of a net which leads the fish toward the trapping portion. (In sport fishing, a leader is a piece of gut or wire attached to the line and the snell of a hook).
- LEAD LINE**—A line strung along the bottom of a net and bearing weights so that the bottom of the net will sink.
- LEEWARD**—Away from the wind.
- MESH**—The meshes of a net are the individual open spaces bounded by the twine of the net.
- OTTER BOARD**—A door-sized device made of wood or other suitable material attached by a bridle to the towlines of an otter trawl so that when the net is towed, pressure of the water against the otter boards forces them outward, keeping the mouth of the net open.
- POCKET**—See "Pound."
- POLE**—See "Stake."
- POT**—See "Pound."
- POUND**—The enclosure which retains the fish trapped by a pound net.
- POUND HEAD**—See "Head."
- QUARTER LINE**—An extra line to help haul in an otter trawl after it has reached the side of the ship.

- RIG—(1) *v.* To fit up any apparatus for use.
(2) *n.* An apparatus fitted up for use.
- SHACKLE—(1) *n.* A fastening of metal.
(2) *v.* To fasten with a shackle.
- STAKE—A pole used to support the netting of a fish trap. One end is sunk into the bottom by manpower, piledriver or hydraulic jet.
- STAKE GILL NET—A gill net which is held stationary in the water by means of stakes or poles, driven into the bottom.
- THROAT—See "Funnel."
- TRAWL BOARD—See "Otter Board."
- TRAWLER—A sea-going fishing vessel that fishes with a drag net or otter trawl.
- TUNNEL—See "Funnel."
- WINCH—On a trawler, the winch is a power-operated winding drum used for pulling operations.
- WINDWARD—Toward the wind.
- WING—A side piece of a net, projecting from mouth or bunt of the net.

NAMES OF MARYLAND'S COMMERCIALY IMPORTANT FISHES*

A. Caught primarily in the Bay and Tributaries:

Largemouth Black Bass — *Micropterus salmoides*.

Carp — *Cyprinus carpio*.

Catfish or Bullhead

Ictalurus catus — White Cat; Channel Cat of the Potomac.

Ameiurus nebulosus — Horned Pout; Common Bullhead; Small Catfish; Schuylkill Cat; Sacramento Cat.

Ameiurus ponderosus — Mississippi Catfish.

Ictalurus punctatus — Mississippi Catfish; White Cat; Silver Cat.

Crappie (Bachelor; New Light; Campbellite; Sac-a-Lait; Crapet) — *pomoxis* sp.

Black Drum (Drum) — *Pogonias cromis*.

Flounder — *Pseudopleuronectes americanus*.

River Herring ("Alewives")

Pomobolus pseudoharengus — Branch Herring; Alewife; Wall-eyed Herring.

Pomobolus aestivalis — Glut Herring; Blueback; Blackback; Summer Herring; Kyack; Sawbelly.

White Perch — *Morone americana*.

Yellow Perch (American Perch; Ringed Perch; Raccoon Perch) — *Perca flavescens*.

Pike (Pickerel, Green Pike) — *Esox reticulatus*.

Yellow Pike (Pike Perch; Wall-eyed Pike; Glasseye; Susquehanna Salmon) — *Stizostedion vitreum*.

Gizzard Shad (Mud Shad) — *Dorosoma cepedianum*.

Hickory Shad (Tailor Herring; Fall Herring; Mattowaca) — *Pomobolis mediocris*.

Sucker ("Mullet"; Red horse) — *Moxostoma macrolepidotum*.

Sunfish (Bream; Pond-fish; Pumpkin-seed; Sunny) — *Lepomis gibbosus*.

B. Caught in both the Bay and the Ocean:

Red Drum (Channel Bass; Redfish; Pescada Colorado; Bull Redfish) — *Sciaenops ocellatus*.

Bluefish (Snap Mackerel; skipjack; Fat-back; Tailor) — *Pomatomus saltatrix*.

Butterfish — *Poronotus triacanthus*.

Croaker (Hardhead; Roncadina; Corvina) — *Micropogon undulatus*.

* According to Truitt et al. (1929, "The Fishes of Maryland") there are 228 species of fish of all kinds recorded from Maryland. This list gives only those species that are of commercial importance for which official catch records are kept.

- Common Eel — *Anguilla rostrata*.
 Menhaden ("Alewives"; Mossbunker; Alewife; Bony-fish; White-fish; Bug-fish; Fatback; Yellow-tail; Pogy) — *Brevoortia tyrannus*.
 Sand Perch (Mademoiselle; King William Perch; Yellow-tail) — *Bairdiella chrysura*.
 Rock (Striped Bass; Rockfish) — *Roccus saxatilis*.
 Shad (American Shad; North River Shad; Potomac Shad) — *Alosa sapidissima*.
 Spot (Goody; Post-croaker; Oldwife; Lafayette) — *Leiostomus xanthurus*.
 Gray Trout (Weakfish; Squeteague) — *Cynoscion regalis*.
 Spotted Trout (Spotted Weakfish) — *Cynoscion nebulosus*.
- C. Caught primarily in the Ocean:
- Sea Bass (Black Will) — *Centropristes striatus*.
 Bonito — *Sarda sarda*.
 Cod (Common Codfish) — *Gadus callarias*.
 Daylight (Window Pane) — *Lophopsetta maculata*.
 Fluke (Summer Flounder) — *Paralichthys dentatus*.
 Hake — *Urophycis regius*.
 Squirrel Hake — *Urophycis chuss*.
 Mackerel — *Scomberomus maculatus*.
 Porgy (Scup; Scuppaug) — *Stenotomus chrysops*.
 Sturgeon — *Acipenser oxyrinchus*.
 Swellfish (Puffer) — *Spheroides maculatus*.
 Whiting — *Merluccius biliniaris*.
 King Whiting — *Menticirrhus* sp.

hite-fish;
grannus.
tail) —

— *Alosa*

ostomus

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